Yacht Devices

User Manual

Tank Adapter YDTA-04

also covers models
YDTA-04N

Firmware version
1.00

2021

Yacht Devices Tank Adapter YDTA-04 is certified by the National Marine Electronics Association.

Contents

Package Contents

Device	1 pc.
Screws	2 pc.
This Manual	1 pcs.
Paperclip for reset	1 pcs.
NMEA 2000 Drop Cable	not supplied

Introduction

The NMEA 2000 Tank Adapter YDTA-04 (hereinafter Adapter or Device) allows you to connect an existing resistive or voltage-output type fluid level sensor installed on a tank and display the fluid level on NMEA 2000 devices, including chart plotters and instrumental displays.

The Adapter can be configured to report one of the 15 fluid types defined in the NMEA 2000 standard, including Diesel Fuel, Gasoline Fuel, Oil, Fresh Water, Waste Water, Black Water (Sewage), or Live Well.

The Device can be used with European (10 to 180 Ohm range), American (240 to 33 Ohm range) or Japanese (0 to 310 Ohm range) standard fluid level sensors as well as with any nonstandard sensors with maximum resistance less than 400 Ohm. The Device can also be used with fluid level sensors, which output an analog voltage signal in the range of 0 to 16 Volts.

The Adapter can be installed as a standalone measuring device, in parallel with an existing analog gauge (2-coils and 1-coils gauges are supported), or in parallel with a Volvo Penta engine's MDI (Mechanical Diesel Interface) box. The four measuring channels of the Device may have individual settings. Fluid tank level sensor readings can be calibrated with 12 calibration points to get accurate readings on tanks of any shape.

The Adaptor can switch the load channels of NMEA 2000 digital switching equipment on or off. Up to eight different conditions for each measuring channel can be used.

The Device is equipped with a hidden button that allows switching among 15 configuration presets (see Section V). However, for advanced configuration (calibration curves, digital switching functions, connection in parallel with analog gauges, using voltage sensors) the NMEA 2000 PC gateway (from any manufacturer) or MFD which allows editing of installation description strings (see Section VI) is required.

Firmware updates are available only with Yacht Devices gateways (Wi-Fi, USB or Ethernet), see Section VIII for details.

The Device is powered from the NMEA 2000 network and provides high voltage galvanic isolation between NMEA 2000 and sensor inputs.

We thank you for purchasing our Devices and wish you happy voyages!

Warranty and Technical Support

1. The Device warranty is valid for two years from the date of purchase. If a Device was purchased in a retail store, the sale receipt may be requested when applying for a warranty claim.

2. The Device warranty is terminated in case of violation of the instructions in this Manual, case integrity breach, or repair or modification of the Device without the manufacturer's written permission.

3. If a warranty request is accepted, the defective Device must be sent to the manufacturer.

4. The warranty liabilities include repair and replacement of the goods and do not include the cost of equipment installation and configuration, as well as shipping of the defective Device to the manufacturer.

5. Responsibility of the manufacturer in case of any damage as a consequence of the Device's operation or installation is limited to the Device cost.

6. The manufacturer is not responsible for any errors and inaccuracies in guides and instructions of other companies.

7. The Device requires no maintenance. The Device's case is non-dismountable.

8. In the event of a failure, please refer to Appendix A before contacting technical support.

9. The manufacturer accepts applications under warranty and provides technical support only via e-mail or from authorized dealers.

10. The contact details of the manufacturer and a list of the authorized dealers are published on our website: http://www.yachtd.com/

I. Product Specification

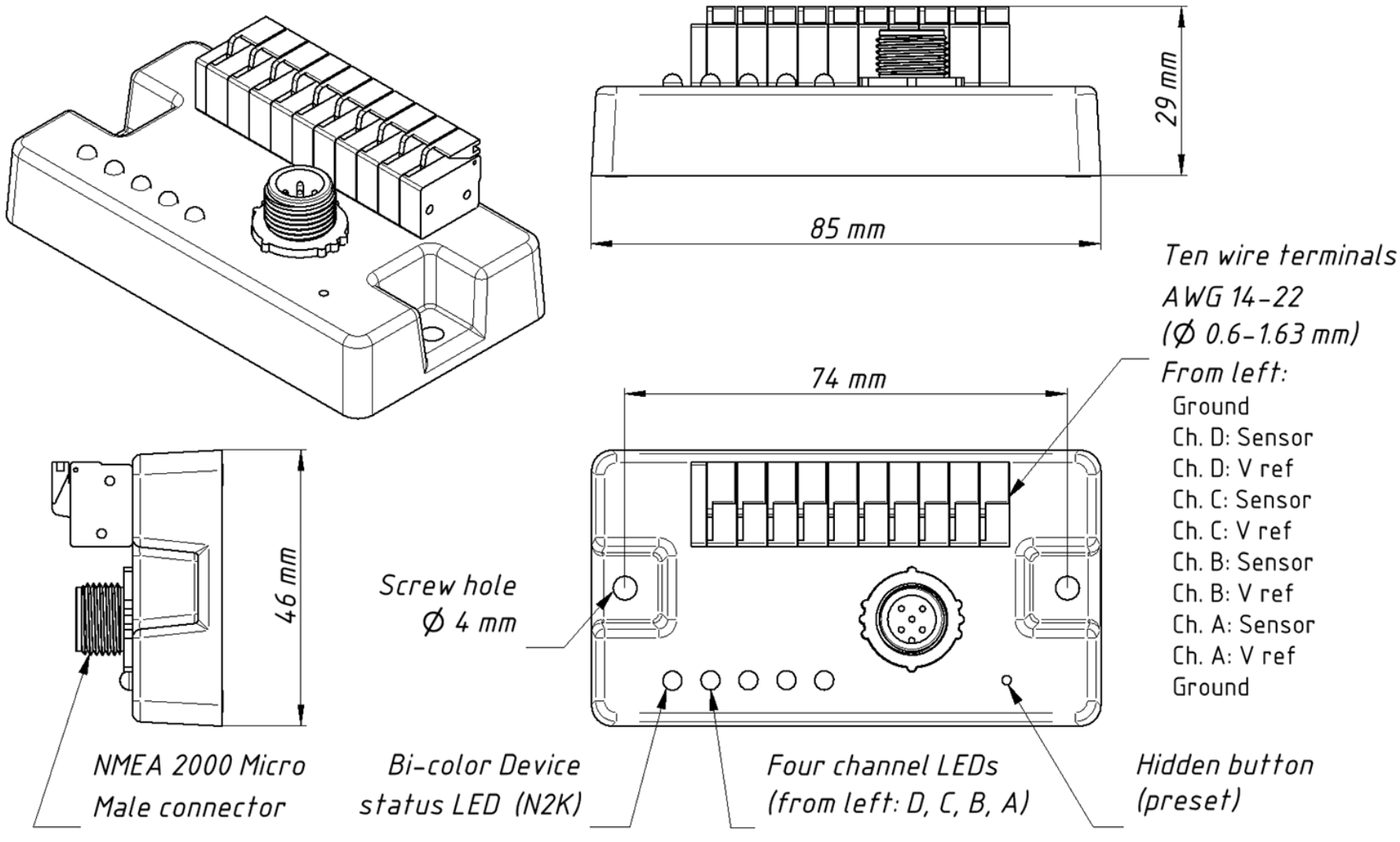


Figure 1. Drawing of Tank Adapter YDTA-04N

Device parameter	Value	Unit
Supply voltage (from NMEA 2000 network)	7..16	V
Current consumption (from NMEA 2000 network), avg./max	51 / 62	mA
Load Equivalency Number	2	LEN
Galvanic isolation between NMEA 2000 interface and sensor inputs	2500	V_{RMS}
Number of measurement channels	4	
Maximum voltage on sensor and gauge reference voltage inputs	16	V
Voltage output sensor supported range	0..16	V
Fluid level sensors resistance range	0..400	Ohm
Analog gauge coils resistance range	0..10 000	Ohm
Sensor resistance/voltage measurement accuracy	±1	%
Device case dimensions (LxWxH)	85 x 46 x 29	mm
Weight	50	g
Operating temperature range	-20..55	°C

CE Yacht Devices Ltd declares that this product is compliant with the essential requirements of EMC directive 2004/108/EC.

Dispose of this product in accordance with the WEEE Directive. Do not dispose of electronic refuse with domestic or industrial waste.

II. Installation and Connection of Device

All connections should be made when the power is cut off at the circuit breaker. This will protect against accidental short circuits during installation.

Connect the Device to the tank level sensor before making the connection to the NMEA 2000 network. This will protect against accidental sparks which can be hazardous when working with fuel tanks.

The Device requires no maintenance. When deciding where to install the Device, choose a dry mounting location. Despite the fact that the Device's case is waterproof, its wire terminals are open, and seawater can cause corrosion or a short circuit. Do not place the Device where it can be flooded by water, get wet in rain or be sprayed by water.

The Device has two mount holes (see Section I), 4 mm in diameter. Use the supplied screws to fix the Device on a flat surface. The orientation is not important. However, when the holes of wire terminals are pointing down, they are better protected from occasional spray.

1. Tank level sensor connection

The Device has four measurement channels (A, B, C, D) which share a common electrical ground (two Ground wire terminals, labeled as GND, are connected inside and galvanically isolated from the NMEA 2000 ground).

The channel contains two individual inputs: a sensor input (labeled as SENS), which should be connected to the tank sensor, and a voltage reference input (labeled as VREF), used in parallel connection with analog gauges.

Different channels may have different connection schemes and settings. In this section, we will show an example of the possible connections for one channel, and channel name will be omitted on the drawings.

1.1 Standalone sensor connection

If you do not have a gauge connected to your tank level sensor (e. g. you have installed the sensor yourself), you should connect only two wires to the Adapter: from SENS to the sensor «Signal» or «+» output and from GND to sensor «Ground» or «–». The VREF input should be left unconnected. The CONNECTION setting for the channel should be set to RESISTIVE (refer to Section VI); this is the factory setting.

1.2 Sensor for Volvo engines with MDI unit

If the fuel tank level sensor is connected to the Volvo engine MDI (Mechanical Diesel Interface) unit, you can connect the Adapter in parallel with the MDI unit «Fuel level» input: the SENS terminal should be connected to MDI pin 11 (or the sensor's Green wire) and GND terminal to the MDI pin 12 (or sensor Green/Black wire). VREF terminal should be left unconnected. You should also configure the channel and set the CONNECTION setting to MDI (refer to Section VI).

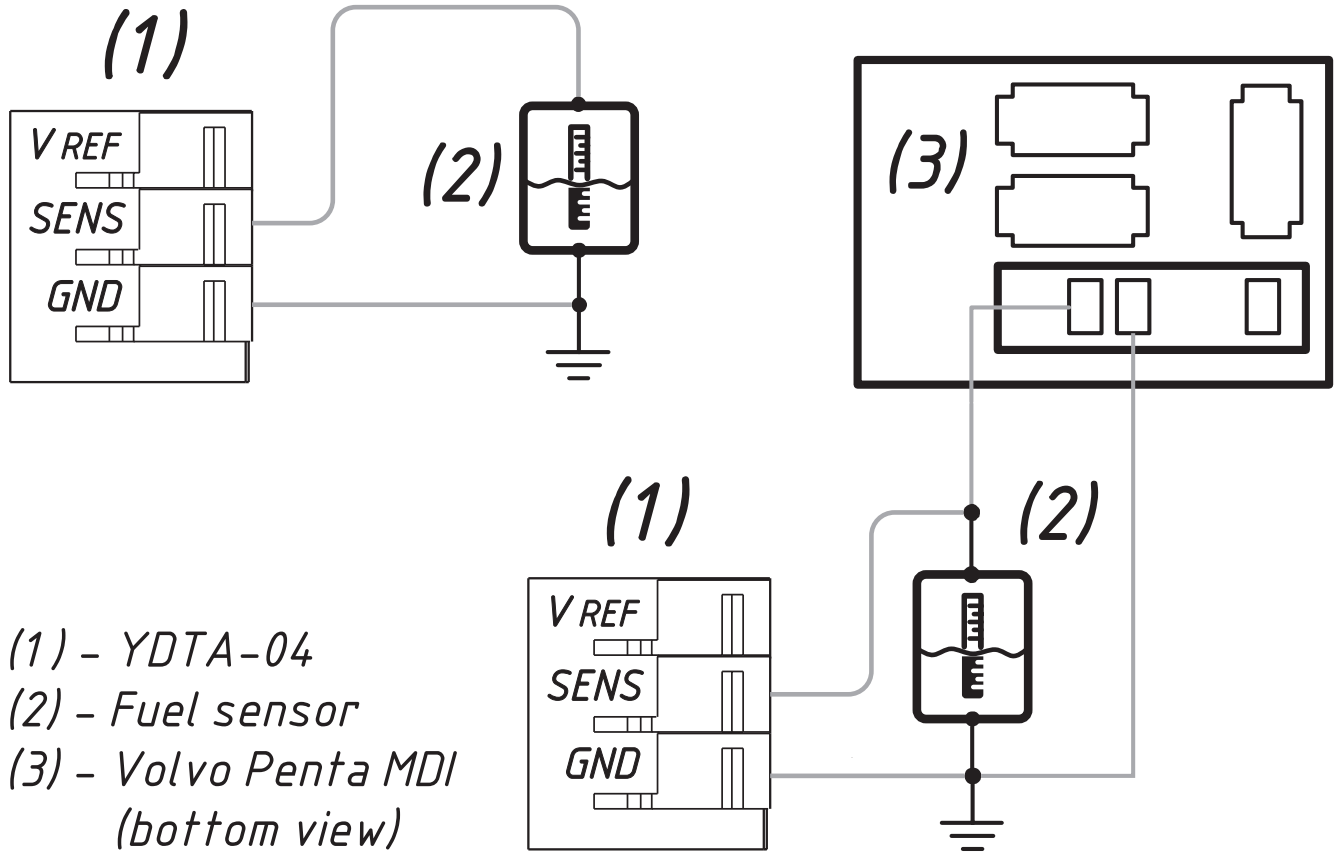


Figure 1. Standalone sensor connection (left) and connection in parallel with Volvo MDI unit (right)

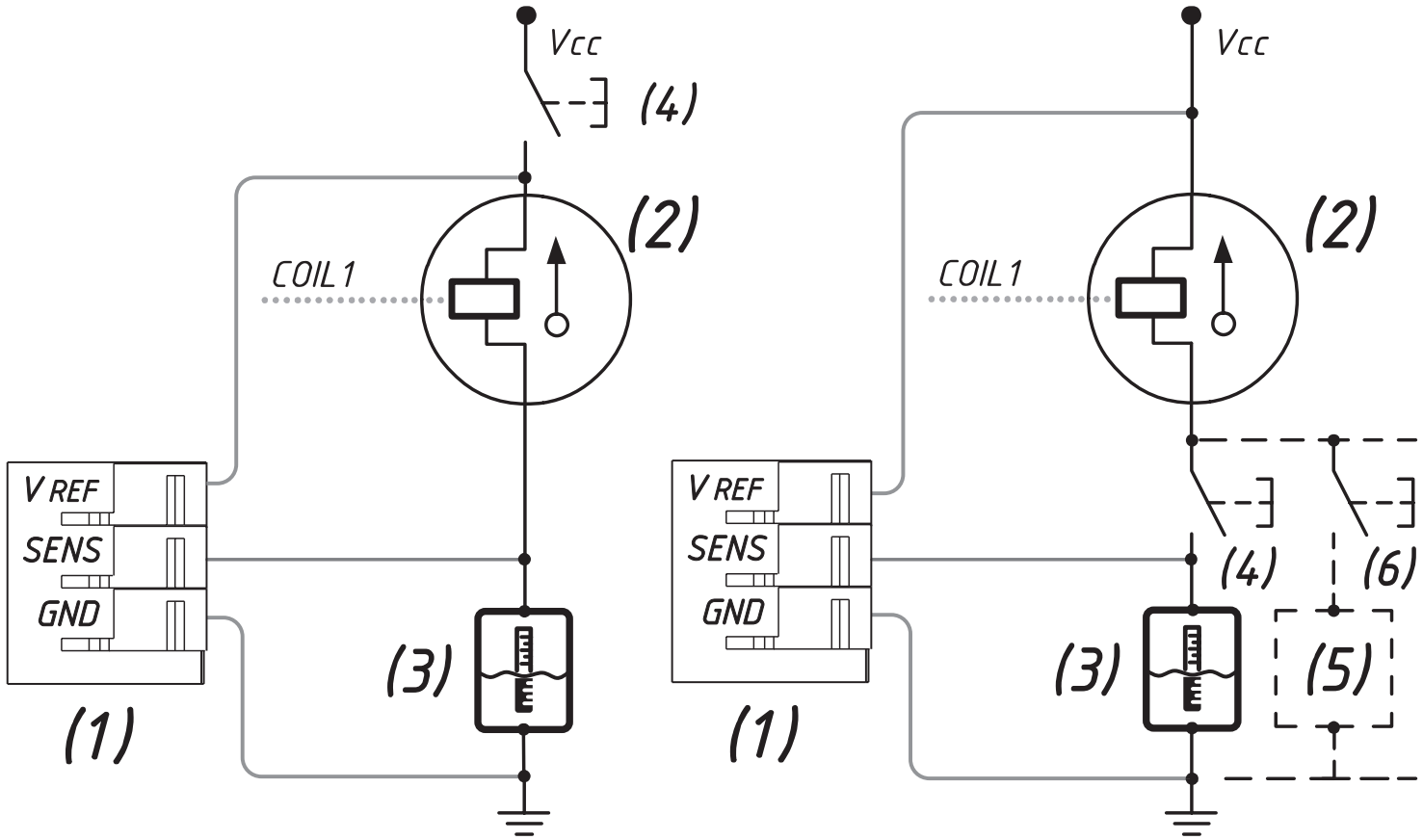
1.3 Connection in parallel with an existing analog gauge

An analog gauge connected to your tank level sensor can be of two types: with one measuring coil (the gauge has only two terminals) or with two measuring coils (the gauge has three terminals).

You may have a «combined» gauge equipped with several buttons (see Figure 2), one of which activates measurement of the tank level. The Adapter detects whether the button pressed or not, and this does not affect the measurement results.

1.3.1 Connection to a 1-coil gauge

If the gauge has one coil, the VREF input should be connected to the gauge's power terminal (up to 16 Volts), the SENS terminal to the gauge «Signal» input, and the GND terminal to the fuel sensor's ground terminal. If you have the «combined» gauge, connect the SENS terminal to the fluid level sensor output (or «+») before the button. You should also configure the channel and set the CONNECTION setting to 1COIL (refer to Section VI.3.1).



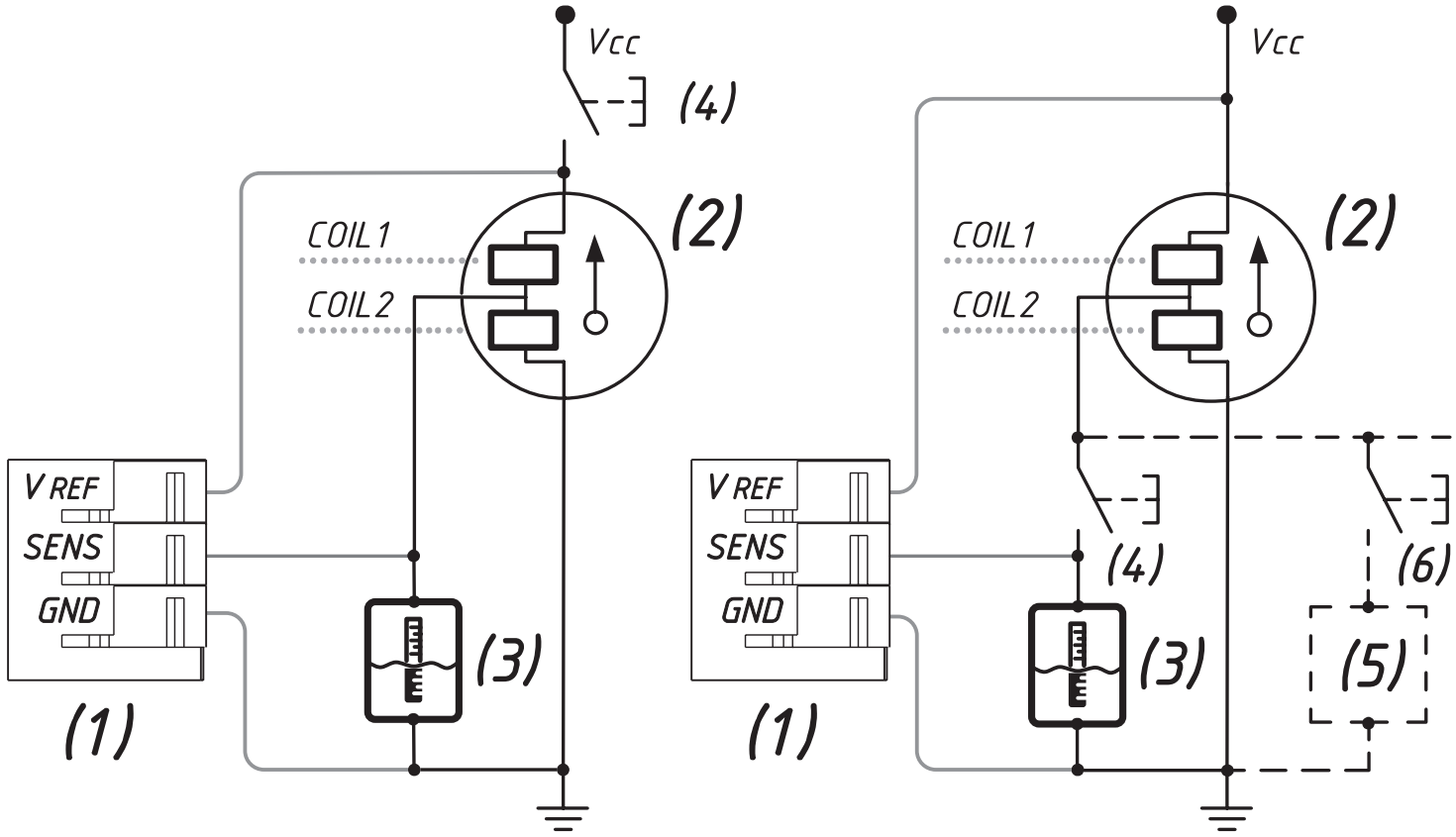
(1) — YDTA-04, (2) — Gauge, (3) — Fuel Sensor, (4) — Optional Button, (5) and (6) — Parallel Sensors (optional)

Figure 2. Connection in parallel with an existing 1-coil analog gauge

1.3.2 Connection to a 2-coil gauge

If the gauge has two coils, the VREF terminal should be connected to the gauge's power terminal (up to 16 Volts), the SENS terminal to the gauge's «Signal» input (or to the fluid level sensor's «Signal» wire after the measurement activation button, see Figure 3), and the GND terminal to the gauge's «Ground» terminal.

You should also configure the channel and set the CONNECTION setting to 2COIL for connection scheme shown on the right part of Figure 3 (or if your gauge has no buttons) or to 2COIL_VCC for connection scheme shown on the left part of Figure 3 (see Section VI.3.1).



(1) — YDTA-04, (2) — Gauge, (3) — Fuel Sensor, (4) — Optional Button, (5) and (6) — Parallel Sensors (optional)

Figure 3. Connection in parallel with an existing 2-coil analog gauge

1.3.3 Neutralize gauge effects

When using an Adapter with an existing gauge, you will need to measure its coil resistance values with an ohmmeter or multimeter and set the measured values to the configuration with the command YD:OHMS_GAUGE (refer to Sections VI.3.3).

To make an accurate measurement, you will need to warm up your gauge: turn it on and let it operate for approx. 15 minutes. When you are ready, promptly disconnect the gauge and measure the COIL 1 resistance — between the gauge reference voltage source (+12V) input and sensor «signal» input. For a 2-coil gauge, you should also measure the COIL 2 resistance — between the gauge «signal» input and gauge «ground» input. To increase accuracy, make several measurements and take the average value.

1.4 Connection to a voltage-output sensor

Check your voltage-output sensor specifications, it should support output of an analog voltage signal in the range of 0 – 16 Volts. Configure the sensor to activate this output mode if necessary. Connect the SENS terminal to the «Voltage» output of the sensor and the GND terminal to «Ground» or «–» of the sensor. If you have a sensor with an additional reference voltage output, connect it with VREF terminal, this will increase the measurement accuracy. Otherwise, the VREF terminal should be left unconnected. You should also configure the channel and set the CONNECTION setting to VOLTAGE and configure voltage settings (refer to Section VI.3).

1.5 Parasitic sensor wire resistance compensation

If you connect the Device directly to a fluid level sensor, but the wire which connects the fluid level sensor to a «Signal» input of an analog gauge is too long, it may add an additional fixed value to the gauge coil resistance, which can cause a persistent measurement error. If the total sensor wire length is greater than 5 meters, it is recommended to measure the resistance with an ohmmeter or multimeter and set the measured value in the channel's configuration parameter OHMS_WIRES (refer to Section VI.3.4).

2. Connection to NMEA 2000

The Device should be connected to the NMEA 2000 network backbone with a NMEA 2000 drop cable (not supplied with the Device). The Device is equipped with a DeviceNet Micro Male connector. For NMEA 2000 networks with other connector types, you will need an appropriate adapter cable.

Before connecting the Device, turn off the bus power supply. If you have any questions regarding the use of connecting cables, terminators or connectors, please refer to the following documents:

- Technical Reference for Garmin NMEA 2000 Products (190-00891-00) for standard NMEA 2000 networks;
- SeaTalk NG Reference Manual (81300-1) for Raymarine networks.

After connecting the Device, close the lock on the connector to ensure its water resistance and reliability.

The Device is powered from the NMEA 2000 network and has LEDs, which flash red or green. After the NMEA 2000 network power is turned on, the status LED (labeled “N2K”) should produce one long and three short green flashes. If this does not happen, refer to Appendix A.

You can also check the NMEA 2000 connection and firmware version from a chart plotter. The Device information including the firmware version is displayed in the list of NMEA 2000 devices (SeaTalk NG, SimNet, Furuno CAN) or in the common list of external devices on the chart plotter. Usually, access to this list is in the «Diagnostics», «External Interfaces» or the «External devices» menu entry of the chart plotter.

III. LED Signals

The Devices incorporates a bi-color Device status LED (labeled “N2K”) and four channel status LEDs. Their locations are pictured in Section I on Figure 1.

1. Powering on

One 1-second long GREEN flash of the status LED after powering on the Tank Adapter confirms successful initialization. Further, three successive GREEN flashes of the status LED indicate that the Device is successfully connected to the NMEA 2000 network.

Constant RED flashes (one second on, one off) of the status LED indicate a failure to obtain an NMEA 2000 network address.

2. Normal operation

During normal operation, the Device’s status LED blinks every 2.5 seconds. GREEN flashes mean that all messages were sent by the Device without errors, RED indicates a problem on the NMEA 2000 backbone.

Channel LEDs do not flash if no problems with the channel are found, otherwise channel LED flashes RED every 2.5 seconds to indicate the problem with sensor or configuration. If you turned on the Device without connected sensors, it is normal that all channel LEDs flash RED.

If you have unused measurement channels on the Device, you can turn them off (see Section VI.3.1).

3. Signals during configuration with button

The LEDs' behavior during configuration with hidden button is described in the Section V.

4. Signals during firmware update

The LEDs' behavior during firmware update is described in the Section VIII.

IV. Device Configuration and Settings

Configuration of the Device should not be performed at sea.

The Device can be configured by two different methods:

1. By selecting one of predefined configuration presets using the hidden button. This method is limited by standard resistive sensors and connection with Volvo Penta MDI units, and does not allow configuration of the calibration curves, digital switching functions, setup of the connection in parallel with analog gauges, or use of the voltage sensors.
2. With a special set of commands which can be entered into the installation description field of the Device using PC software like CAN Log Viewer developed by our company, ActiSense NMEA Reader or Maretron N2KAnayzer. This method is very simple and may be supported in some chart plotter models.

All settings configured with the second method will be lost after switching the preset with the first method. When you selected the preset with the first method and alter any setting with the second method, the actual preset number will be changed to 15 (user-defined preset, see the Section V).

The most important settings are:

A. **Tank number.** Also known as NMEA 2000 data instance. The first tank should have the number 0. Numbering is individual for each fluid type, e.g. the first diesel tank and first fresh water tank both have number 0.

B. **Fluid type.** The Devices support all fluid types available in NMEA 2000: diesel, fresh water, waste, live well, oil, sewage (black water), and gasoline. These types have numbers 0 - 6. You can also use numbers 7 – 15, which are reserved in NMEA 2000 and have no defined meaning. Note that chart plotters usually support only a few of them, and even gasoline tanks are not supported in many chart plotters.

C. **Connection type.** The Adapter support multiple sensor's types (resistive, voltage, Volvo Penta MDI) and different connection schemes (standalone, in parallel with 1-coil or 2-coil gauges). In case of a parallel connection, you should measure the resistance of a gauge's coils and specify it in the Device's settings; this is possible with the second configuration method only.

With the factory settings, Device channels are configured for using with USA resistive sensors (240 Ohms when empty, 33 Ohms when full). Tank numbers for channels A, B, C, and D, are 0, 1, 2, and 3 correspondingly. Fluid type is set to diesel for all channels. These settings are correspond to configuration preset #1.

Aside from the connection type and fluid type, the following settings (can be configured with the second method only) can improve the accuracy of readings:

D. **Calibration.** Resistive fuel level sensors do not take the shape of the fuel tank into account, therefore, the readings usually have substantial error. The same issue is applicable to the voltage-output sensors which do not have an internal calibration mechanism or do have a non-linear output. The Adapter allows setting a 12-point calibration curve for each channel.

E. **Capacity.** If the capacity for a tank is specified, your MFD will allow display of a tank's level not only in percent, but in liters or gallons also. In factory settings, capacity for all tanks is set to UNKNOWN.

F. **Damping.** With factory settings, the Adapter transmits the average value measured in last 3 seconds. This can be too small for rough sea conditions and too big for some applications (e.g., controlling of live well pump or fuel pump with digital switching).

We recommend learning about both configuration methods before configuring the Device.

V. Configuration with Presets (Button)

Press the hidden button (see Figure 1 in Section I) with the paper clip supplied with the Device. The status LED of the Device will constantly shine RED and channel LEDs will display the preset number in binary (A is the lowest bit, D is highest, see the Table 1 below) when the hidden button is pressed.

Wait 2-3 seconds and the LEDs lights will start flashing. Release the button to enter the programming mode. Otherwise, when LEDs will stop blinking 2-3 seconds later, release the button to return to normal operation.

In the programming mode, each press of the button increases the preset number. After preset 15 (all channel LEDs are on, binary 1111), the preset number will be reset to 1 (only the channel's A LED is on, binary 0001). Settings of the active preset will be applied immediately, and you can check the configuration on MFD screen or instrument displays (are numbers correct or not).

To save the selected preset, press the button and hold it for 3 seconds until all LEDs start blinking. After saving, the Device will return to normal operation mode.

To return to normal operation mode without saving, do not press the button for 30 seconds, and the Device will restore the configuration that was active before entering the programming mode, and return to normal operation.

Table 1. Configuration presets

Preset (DCBA)	**Description**
1 (0001)	**Factory settings.** Channels ABCD are configured to USA (240..33 Ohm) resistive sensors of fuel tanks with numbers 0..3.
2 (0010)	Channels ABCD are configured to EUR (10..180 Ohm) resistive sensors of fuel tanks with numbers 0..3.
3 (0011)	Channels ABCD are configured to JAP (0..310 Ohm) resistive sensors of fuel tanks with numbers 0..3.

Table 1 continued

4 (0100)	Channels AB are connected to fuel tanks (0 and 1), and CD to water tanks (0 and 1). Sensors are of resistive type (USA, 240..33 Ohm).
5 (0101)	Channels AB are connected to fuel tanks (0 and 1), and CD to water tanks (0 and 1). Sensors are of resistive type (EUR, 10..180 Ohm).
6 (0110)	A – fuel tank (0), B – waste tank (0), CD – fresh water (0 and 1). Sensors are of resistive type (USA, 240..33 Ohm).
7 (0111)	A – fuel tank (0), B – waste tank (0), CD – fresh water (0 and 1). Sensors are of resistive type (EUR, 10..180 Ohm).
8 (1000)	A – MDI unit (fuel tank 0), B – waste tank (0), CD – fresh water (0 and 1). Sensors are of resistive type (USA, 240..33 Ohm).
9 (1001)	A – MDI unit (fuel tank 0), B – waste tank (0), CD – fresh water (0 and 1). Sensors are of resistive type (EUR, 10..180 Ohm).
10 (1010)	AB – MDI units (fuel tanks 0 and 1), CD – fresh water (0 and 1). Sensors are of resistive type (USA, 240..33 Ohm).
11 (1011)	AB – MDI units (fuel tanks 0 and 1), CD – fresh water (0 and 1). Sensors are of resistive type (EUR, 10..180 Ohm).
12 (1100)	**Reserved for future use.** In the 1.00 firmware is identical to preset 1 but with tank numbers 4-7.
13 (1101)	**Reserved for future use.** In the 1.00 firmware is identical to preset 2 but with tank numbers 4-7.
14 (1110)	**Reserved for future use.** In the 1.00 firmware is identical to preset 3 but with tank numbers 4-7.
15 (1111)	**User defined.** Settings was configured or altered with installation description strings (see Section VI).

VI. Configuration with Installation Description Strings

Installation description strings are stored in the Device's memory and are usually written by installers to specify the device location or to leave notes or contact information. They can be set with a PC software and a hardware gateway to the NMEA 2000 network. Some models of chart plotters also allow editing of installation description strings. Please refer to your software or chart plotter documentation for details.

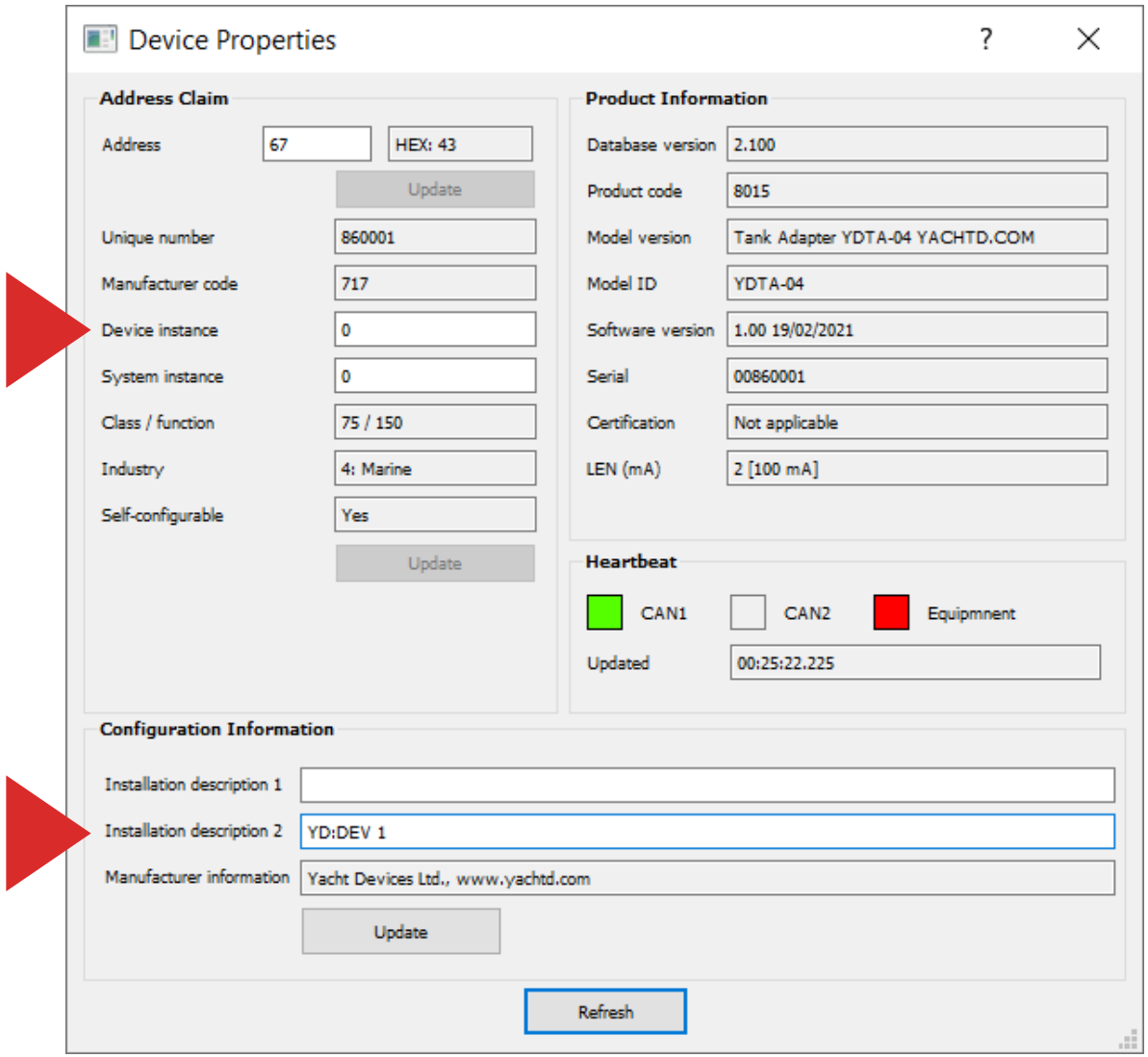


Figure 1. Programming with CAN Log Viewer

To program the Device, enter a special string starting with «YD:» to the installation description field 2 in the Device properties. For example, «YD:DEV 1» (without quotes) will change the NMEA 2000 device instance of the Device to 1. If the command is accepted by the Device, it will add «DONE» to the entered text and «YD:DEV 1 DONE» will be displayed in this installation description field. If a command is entered without the last parameter, the device replies with the current value of the parameter.

In Figure 1 on the previous page, you can see the process of programming the Device with free CAN Log Viewer software (to open this window, select the item «NMEA 2000 Devices» in the «View» menu, refresh the list of devices, select the device and click «Properties» button). You can download this program (runs on Microsoft Windows, Mac OS X and Linux) at: http://www.yachtd.com/downloads/

Yacht Devices NMEA 2000 Wi-Fi Gateway, Yacht Devices NMEA 2000 Ethernet Gateway, Yacht Devices NMEA 2000 USB Gateway or Yacht Devices NMEA 2000 Wi-Fi Router is required to connect the PC to the NMEA 2000 network.

The CAN Log Viewer also allows you to modify the NMEA 2000 device instance by entering a value in the dedicated field (see «Address Claim» group on the screenshot). After entering the command as shown in Figure 1 (click the «Update» button to apply changes), the value in the «Device Instance» field will be changed to 1, and «Installation Details 2» field will be changed to «YD:DEV 1 DONE».

Parameters in square brackets [] described below can be omitted to obtain the current setting's value.

1. Reset and NMEA 2000 specific commands

1.1 YD:RESET

This command reset Device settings to the default values. Unlike all other commands, it leaves Installation Description String 2 empty.

1.2 YD:PRESET [1..15]

Switches the current configuration to specified preset (see Section V) or return the current preset number if parameter is omitted. The setting is immediately applied and saved to memory.

1.3 YD:DEV [0..255]

Switches NMEA 2000 devices instance to specified value. This setting is used in large NMEA 2000 networks and does not effect the Device's behavior.

1.4 YD:SYS [0..15]

Switches the NMEA 2000 system instance of the Device to the specified value. This setting is used in large NMEA 2000 networks and does not effect on Device's behavior.

1.5 YD:PGN <pgn> [OFF | 0 | 100..60000]

Where: <pgn> is 126993, 127505 or 127496 (see Appendix B)

Set transmitting interval for specified PGN, the value is in milliseconds. OFF or 0 disable periodic PGN transmission.

Example 1. Set the periodic transmission interval for Fluid Level PGN to 1 second:

YD:PGN 127505 1000

Example 2. Obtain the transmission interval for Heartbeat PGN:

YD:PGN 126993

2. Basic channel configuration

2.1 YD:TANK <A..D> [0..252]

The tank number, also known as the NMEA 2000 data instance. The first tank should have the number 0. Numbering is individual for each fluid type, e.g. the first diesel tank and the first fresh water tank both have number 0.

Example 1. Get the tank number of the channel A:

YD:TANK A

Example 2. Set the tank number of the channel B to 5:

YD:TANK B 5

2.2 YD:FLUID <A..D> [type]

Where: [type] can be a number 0..15 or one of NMEA 2000 predefined types, they have numbers 0..6 correspondingly (DIESEL, WATER, WASTE, LIVEWELL, OIL, SEWAGE, GASOLINE)

Sets the fluid type for the specified channel or returns the type if the second parameter is omitted. Note that GASOLINE type (6) and types 7..15 (without defined meaning) are not supported by some chart plotters.

Example: configure the tank of channel B to fresh water, two options:

YD:FLUID B WATER

YD:FLUID B 1

2.3 YD:CAPACITY <A..D> [UNKNOWN | 0..99999]

Sets the capacity of tank at the specified channel in liters. Factory setting is UNKNOWN, with this setting only a percentage value is transmitted to NMEA 2000. Note that chart plotters display the tank volume depending on their own regional settings (liters, US gallons, etc.).

2.4 YD:DAMPING <A..D> [0..600]

The factory settings is 3 (seconds) for all channels. Fluid level values, measured by the fluid level sender, can be unstable in rough sea conditions. You can increase the damping time constant if you find that the fluid level data reported by the Device is too sensitive to the boat attitude. The value 0 turns off the damping.

3. Sensor configuration

3.1 YD:CONNECTION <A..D> [NC | RESISTIVE | 1COIL | 2COIL | VOLTAGE | 2COIL_VCC | MDI]

Sets the sensor type and connection type for specified channel (see Section II). With factory settings, all channels are configured for RESISTIVE type (standalone connection to resistive sensor). The NC type means “not connected” and mark the channel as unused for the Device. The settings below in this section are applied depending on selected connection type.

3.2 YD:OHMS_SENSOR <A..D> [range]

Where: [range] can be specified as two numbers in Ohms, where the first number corresponds to an empty tank and the second to a full tank, or as EUR (equal to 10 180), USA (240 33) or JAP (0 310).

The range specified by numbers is limited by 0..400 or 400..0 intervals, borders can be configured with 0.01 Ohm precision. With factory settings, all channels are configured for USA type of sensors (240 Ohms when empty, 33 Ohms when full).

This setting is applicable only with RESISTIVE, 1COIL, 2COIL, 2COIL_VCC connection types.

Example 1. Configure channel A for a sensor with a range of 235 Ohms (when empty) to 10.45 Ohms (when full):

YD:OHMS_SENSOR A 235 10.45

Example 2. Configure channel B to a European type of the sensor, two options possible:

YD:OHMS_SENSOR B 10 180

YD:OHMS_SENSOR B EUR

3.3 YD:OHMS_GAUGE <A..D> [<0.00..10000.00> [<0.00..10000.00>]]e]

Sets the resistance of analog gauge coils (in Ohms) for parallel connections (1COIL, 2COIL, 2COIL_VCC). For 1-coil gauges, the third parameter should be omitted. For 2-coil gauges, first number is the resistance of Coil 1 and the second is the resistance of Coil 2 (see Figure 3 in Section II).

This setting neutralizes the effects of the gauge caused by its own resistance.

3.4 YD:OHMS_WIRES <A..D> [0.00..100.00]

The sensor wire's parasitic resistance in Ohms. Used for compensation of the sensor wire resistance. Refer to Section II.1.5.

This setting is applicable only with 1COIL, 2COIL and 2COIL_VCC connection types.

3.5 YD:VOLTS_SENSOR <A..D> [<0.00..16.00> <0.00..16.00>]

This setting is applicable to the VOLTAGE connection type only. The second parameter (in Volts) is the sensor's voltage when the tank is empty, and the third is when the tank is full.

Example. Configure channel A for a voltage sensor with a range of 1 to 5 Volts:

YD:CONNECTION A VOLTAGE

YD:VOLTS_SENSOR A 1 5

3.6 YD:REFERENCE <A..D> [0.00..16.00]

This setting is applicable to the VOLTAGE connection type, when the VREF terminal is connected. This setting is ignored when the gauge is not actually powered (see Figures 2 and 3 in the Section II, when the optional button is open). Otherwise, the measured value is compensated by following formula:

$$Level\,(\%) = \frac{Vsensor * \frac{REFERENCE}{Vref} - VOLTS\_SENSOR[EMPTY]}{VOLTS\_SENSOR[FULL] - VOLTS\_SENSOR[EMPTY]} * 100\%$$

Calibration settings are applied to this calculated level value (refer to 4.1 in this Section).

4. Advanced configuration commands

4.1 YD:CALIBRATION <A..D> [p4,p8,...,p95|OFF]

Where: p4,p8,...,p95 — 12 calibration points (decimal values, 0..100)

Resistive fuel level sensors do not take the shape of the fuel tank into account; therefore, the readings usually have substantial error. The same issue is applicable to the voltage-output sensors which do not have an internal calibration mechanism, neither do they have a non-linear output.

This setting defines 12 calibration points for 4, 8, 12, 20, 30, 40, 50, 60, 70, 80, 90 and 95% readings (assuming that 0% and 100% readings do not require calibration). For each point, you should specify the correct display value.

For example, if your fuel gauge shows 50% when the tank actually is only 19% full, then you should set 19 as the value for the 50% calibration point (7th value in the calibration string). To simplify obtaining the calibration string, we prepared an Excel file available on our web site. You only need to specify your gauge's readings and the measured remaining fuel volume to get the calculated calibration string.

4.2 YD:CUSTOM_DATA <A..D> [OFF | 0..9]

Where: the number in the last parameter is Garmin «Custom Channel» number.

Disables/enables Garmin «Custom Channels» mode. In this mode, the Device starts transmitting the measured value as an percent type value (with name YDTA) for the specified «Custom Channel» number with 500ms interval along with «Fluid Level» PGN 127505 for specified channel. This mode can be used only with compatible Garmin NMEA 2000 equipment.

4.3 YD:JOIN [[A][B][C][D] | NONE]

Turns on/off transmission of PGN 127496 “Trip Fuel Consumption, Vessel” with “Estimated Fuel Remaining” field filled by the sum of fuel volume in selected tanks. The CAPACITY (see 2.3 in this section) for selected tanks must be configured.

The transmission interval for this message can be configured with YD:PGN command (see 1.5 in this Section). If some other equipment sent this message, the Adapter will immediately send its own message after it with the corrected value of estimated fuel remaining.

Example 1. Send summarized data from channels A and B in PGN 127496:

YD:JOIN AB

Example 2. Turn off the transmission of PGN 127496:

YD:JOIN NONE

4.4 YD:SW<A..D><1..4> [<ON|OFF> [conditions]]

This setting enables, disables and configures up to 8 rules for each measurement channel to control NMEA 2000 digital equipment. This command is described in the Section VII.

VII. Digital Switching

The Tank Adapter supports NMEA 2000 digital switching equipment (managed with Standard PGNs 127501 and 127502). The Device can send commands to turn on/off electrical loads connected to external NMEA 2000 two-state devices (e. g. relay banks).

The Tank Adapter is compatible (not only) with:

* **Yacht Devices NMEA 2000 Circuit Control YDCC-04.** Circuit Control has one bank of four latching (bi-stable) relays capable of switching direct current (DC) and alternating current (AC) loads. Tank Adapter can be used to automatically fill the main fuel tank from reserve tank, or to stop filling of the live well tank when it is full, or balance two ballast tanks.

* **Yacht Devices Alarm Button YDAB-01.** The Alarm Button is a digital switching «music box»; it has a powerful sound amplifier inside and a connection to a sound speaker. The Tank Adapter can turn ON any of 28 alarm sounds (or even voice messages uploaded by a user) of the Alarm Button. For example, you can activate an alarm when the fuel level is low.

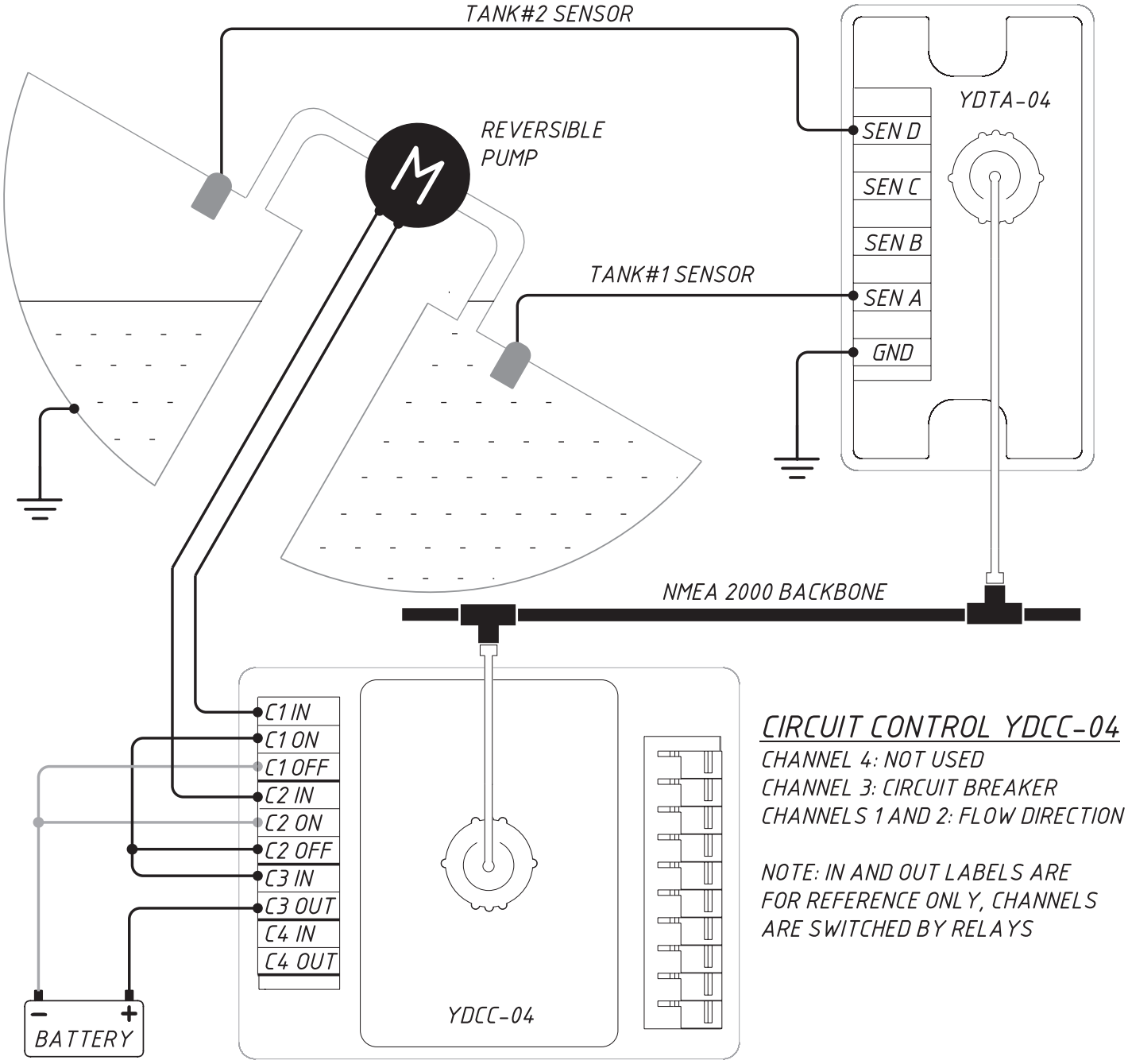
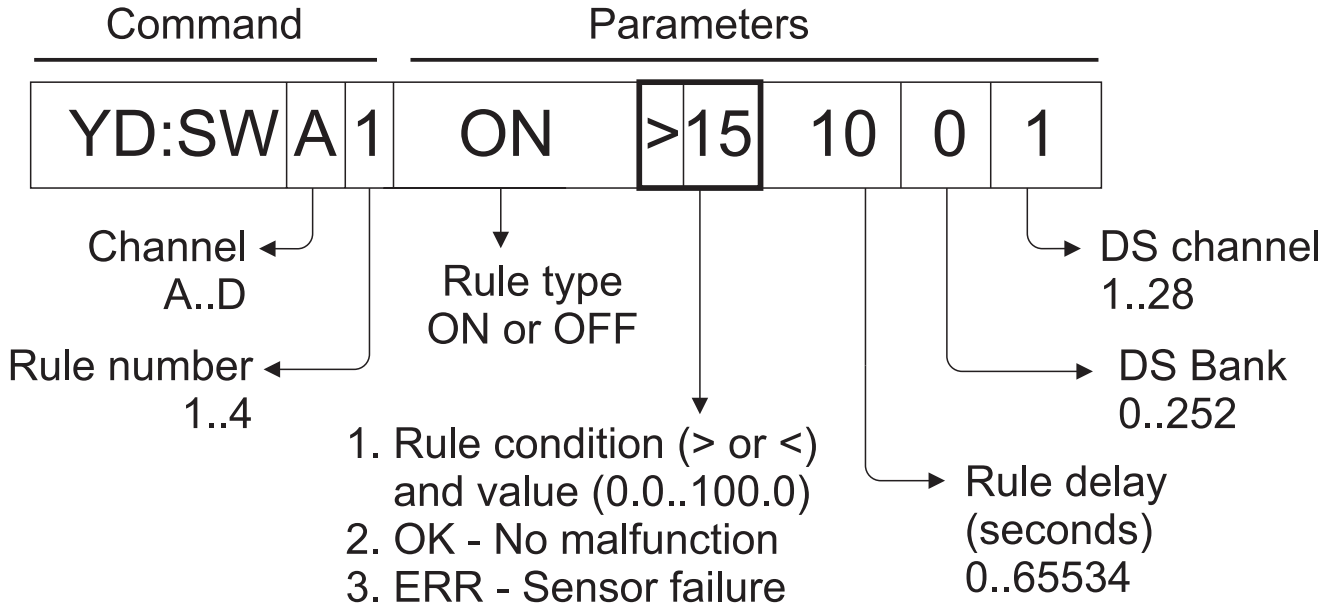


Figure 1. Automatic management of ballast tanks with YDCC-04 and YDTA-04

The Device allows setting up to 8 rules for each measurement channel (A..D), four to switch the digital switching channel ON, and four to switch OFF. The condition can be programmed by tank level (more or less than specified value) or by sensor state (are readings available or sensor is failed).



The common command's syntax is shown above. You can specify one ON and one OFF rule with the same number.

Example 1. Turn on the digital switching channel 1 of the digital switching bank 5 if the sensor connected to channel D is not working at least 10 minutes (600 seconds):

YD:SWD1 ON ERR 600 5 1

Example 2. Turn on digital switching channel 2 of digital switching bank 0 immediately if the level of the tank connected to channel A is less than 20%:

YD:SWA1 ON <20 0 0 2

To turn off the rule, special syntax with the NEVER keyword after the rule type is used.

Example 3. Turn off the ON rule with number 1 at channel A (defined at Example 2):

YD:SWA1 ON NEVER

The command without parameters or with the rule type only, returns the current settings.

Example 4. Get the settings of the ON rule with number 1 at channel D (defined at Example 1):

YD:SWD1 ON

Example 5. Program the Device to manage the ballast tank system shown in Figure 1. When tank 2's level (connected to channel D) is less than 20% (for 10 seconds or more), turn on the pump until the level in tank 2 is more than 70%. When the level in tank 1 (connected to channel A) is less than 20%, turn on the pump in another direction (switch the polarity of reversible pump).

YD:SWA1 ON <20 10 0 1

YD:SWA1 OFF <20 10 0 2

YD:SWA2 ON <20 10 0 3

YD:SWA2 OFF >70 10 0 3

YD:SWD1 ON <20 10 0 2

YD:SWD1 OFF <20 10 0 1

YD:SWD2 ON <20 10 0 3

YD:SWD2 OFF >70 10 0 3

Lines 1-2 and 5-6 above sets the right polarity for the reversible pump. Lines 3 and 7 powers the pump. Lines 4 and 8 turns the pump off.

After the activation (all conditions are met), the rule becomes inactive until conditions will no longer match. Imagine that tank 1 has 10% level and the Tank Adapter runs the pump in the Example 5. When the level reached 15%, the user turned off channel 3 on the YDCC unit manually (from connected buttons or from the MFD screen) and turned off the pump. In this case, the rule on line 3 will not try to run the pump again, despite the level still being less than 20%, because it was already activated. It will be activated again only when the level goes to 20.1% or more, for a at least half of second (with the respect of DAMPING setting, see Section VI.2.4).

Example 6. Turns on digital switching channel 3 on bank 0 if the level in the tank connected to channel A is less than 20% for at least 10 seconds. After 5 minutes (300 seconds plus 10 seconds for activation of the first rule), try to turn on the channel again if the level is still less than 20%.

YD:SWA2 ON <20 10 0 3

YD:SWA3 ON <20 310 0 3

In the example above, the second rule will be activated 5 minutes later, and if the user turned off the channel manually, the second rule will turn the channel on again.

In real conditions, ballast tank management system must take in account the heeling and actual level in tanks (corrected to heeling) to drain or fill the system, or to pump the water between tanks, etc. This cannot be done with the simple rules of the Tank Adapter, but can be programmed with the **Yacht Devices NMEA 2000 Bridge YDNB-07,** which allows executing custom programs to process NMEA 2000 data stream and manage NMEA 2000 devices in the real time. The sample program for the Bridge is available in A

VIII. Firmware Updates

Firmware updates can be done with free CAN Log Viewer software (version 1.35 or later) running on Microsoft Windows, Mac OS X and Linux:

http://www.yachtd.com/products/can_view.html

The program must be connected to an NMEA 2000 network with a Yacht Devices USB Gateway YDNU-02, or a Wi-Fi Gateway YDWG-02, or an Ethernet Gateway YDEN-02, or a Wi-Fi Router YDNR-02.

You can download the latest firmware version for the Tank Adapter YDTA-04 from our website (do not confuse with YDTA-01 model firmware):

http://www.yachtd.com/downloads/

Open the downloaded .ZIP archive with the update and copy the YDTA04.BIN file to the disk. The README.TXT file inside the archive can contain important information regarding the update.

1. Click the «NMEA 2000 Devices» item in the «View» menu.
2. Click the «Refresh» button (see Figure 1 on the next page) in the opened window and wait for the Device to appear in the list.
3. Select the Device and click the «Firmware Update» button.
4. Locate and select the YDTA04.BIN update file on the disk.
5. Wait while the firmware is uploading.

If in doubt, see the video with the update procedure on our web site. During the firmware upload, the Device's status LED (N2K) flashes RED very fast. When the firmware is updated, the Device status LED gives off the sequence of RED and GREEN half-second signals five times and the CAN Log Viewer also informs you that the update is successfully done.

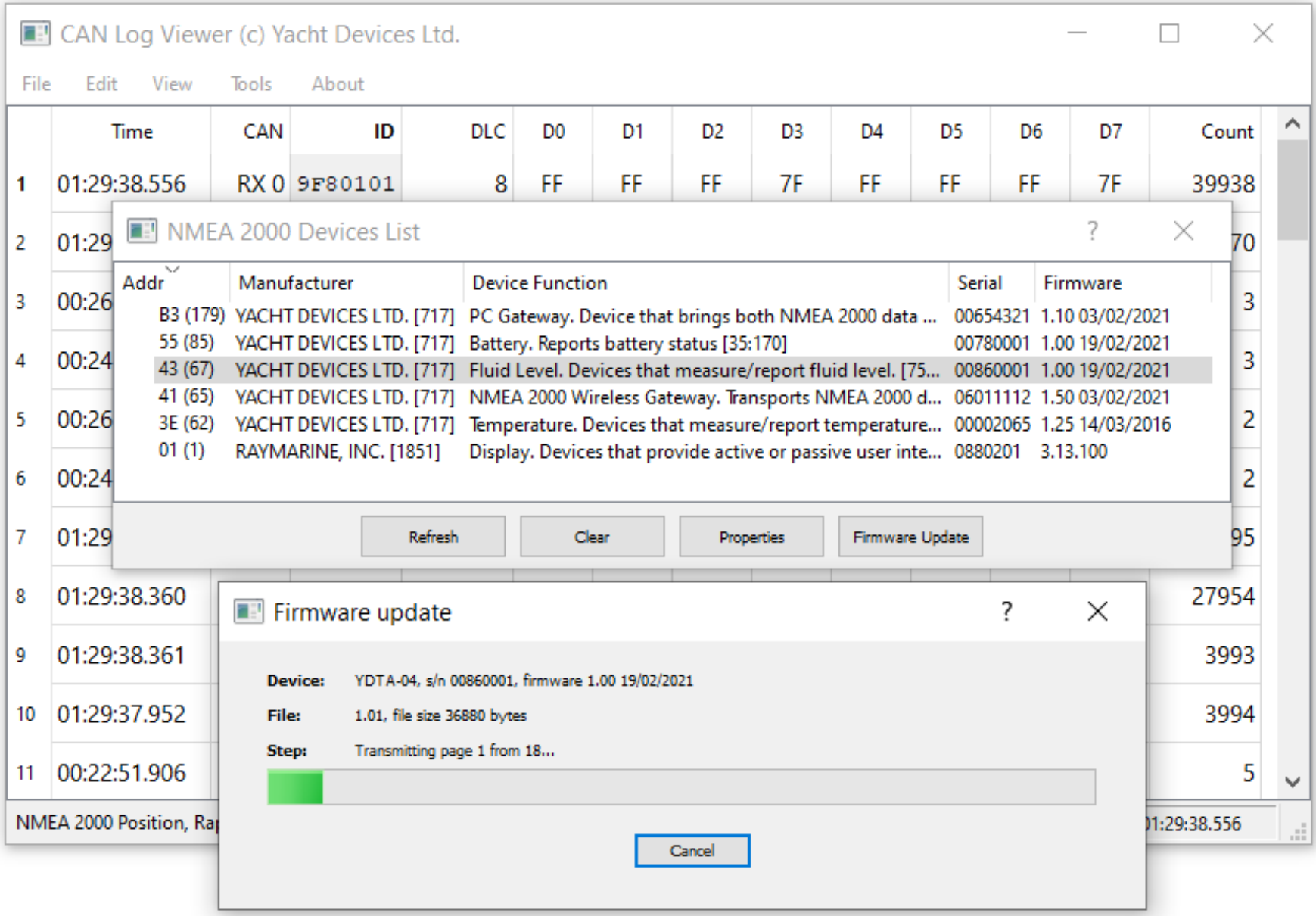


Figure 1. Firmware update with CAN Log Viewer

Appendix A. Troubleshooting

Situation	Possible cause and required actions
No LED indication after the NMEA 2000 network is powered on	**1. No power supply on the bus.** Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and cannot be powered by a chart plotter or another device connected to the network). **2. Loose connection in the power supply circuit.** Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another NMEA 2000 connector.
The status LED produces long (1 second) red flashes continuously.	**1. Device cannot get NMEA 2000 device address.** There are more than 252 NMEA devices already in the NMEA 2000 network. Consider using our NMEA 2000 Bridge YDNB-07 to divide your network into separate segments.
Channel LED flashes RED every 2.5 seconds (MFD displays “Equipment failure” alert for the Device)	**1. Fluid level sensor connection issue.** Check if the fluid level sensor is connected according to the instructions given in Section II. Check the fluid level sensor and its wires for shorts and failed connectivity. **2. Incorrect Device settings** (wrong connection method, sensor resistance range or coil resistances are set in the Device configuration). Reconfigure the Device (refer to Sections IV-VI). **3. No sensor is connected.** Mark the channel as unused (see Section VI.3.1).
Status LED flashes RED every 2.5 seconds	**1. There is a NMEA 2000 network connection issue.** Loose connection in the data circuit. Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another NMEA 2000 connector.

Table continued

Incorrect fluid level readings	**1. Fluid level sensor connection issue.** Check if the fluid level sensor is connected according to the instructions given in Section II. Check the fluid level sensor and its wires for shorts and failed connectivity. **2. Incorrect Device settings** (wrong connection method, sensor resistance range or coil resistances are set in the device configuration). Reconfigure the Device (refer to Sections IV - VI). **3. Fluid level sensor needs calibration.** Perform calibration as described in Section VI.4.1.
The Device is displayed in the list of devices on the chart plotter, but fluid level data does not appear on the screen, status LED flashes GREEN	**1. Incompatible equipment.** Make sure that your hardware supports reception of the «Fluid Level» 127505 PGN. Update the firmware of your equipment if necessary. **2. Fluid level meter or gauge is not enabled in the chart plotter settings.** Check the «data pages customization» section of the chart plotter manual and enable the gauge. **3. Chart plotter does not support selected fluid type** (e.g. GASOLINE). Try to set another fluid type (e. g. DIESEL; refer to Section VI.2.2).

Appendix B. NMEA 2000 Messages Supported by Device

Message	Receive	Transmit
ISO Acknowledgment, PGN 59392 (0xE800)	Yes	Yes
ISO Request, PGN 59904 (0xEA00)	Yes	No
ISO Transport Protocol (DT), PGN 60160 (0xEB00)	Yes	No
ISO Transport Protocol (CM), PGN 60416 (0xEC00)	Yes	No
ISO Address Claim, PGN 60928 (0xEE00)	Yes	Yes
ISO Commanded Address, PGN 65240 (0xFED8)	Yes	No
NMEA Group Function, PGN 126208 (0x1ED00)	Yes	Yes
PGN List Group Function, PGN 126464 (0x1EE00)	No	Yes
Heartbeat, PGN 126993 (0x1F011)	No	Yes (1)
Product Information, PGN 126996 (0x1F014)	No	Yes
Configuration Information, PGN 126998 (0x1F016)	No	Yes
Fluid Level, PGN 127505 (0x1F211)	No	Yes (2)
Trip Fuel Consumption, Vessel, PGN 127496 (0x1F208)	Yes	Yes (3)
Binary Status Report, PGN 127501 (0x1F20D)	Yes	No
Switch Bank Control PGN 127502 (0x1F20E)	No	Yes

Note 1 : Sent every 60 seconds by default, interval can be changed in the Adapter's settings (refer to Section VI). The message reports failed equipment state if any of four external sensors is not connected or malfunction. For unused channels, set the connection type to NC (see Section VI.3).

Note 2: Sent every 2.5 seconds for each channel by default, interval can be changed in the Adapter's settings (refer to Section VI).

Note 3 : Sent only if YD:JOIN command was used (see Section VI.4); the default transmission internal is 1 second, can be changed in Adapter's settings. If some other equipment sent this message, the Adapter will immediately send its own message afterward with the corrected value of the estimated fuel remaining.

Note 4: NMEA 2000 Device Instance, System Instance, Installation Description Field 1 and Installation Description Field 2 can be changed with PGN 126208 (professional NMEA 2000 installer software and hardware may be required)..

Appendix C. Digital Switching with NMEA 2000 Bridge

The program below turns on the ballast pump (see Figure 1 in Section VII) if the heeling is above 20 degrees and if the tank on the relevant side is not 100% full. Please, refer to NMEA 2000 Bridge YDNB-07 manual for details.

```
# Switch direction and run pump commands, PGN 127502
SLOT1 = 000EF20D FF 08 00D1FFFFFFFFFFFF # One direction (on,off,on)
SLOT2 = 000EF20D FF 08 00D4FFFFFFFFFFFF # And another (on,on,off)
SLOT3 = 000EF20D FF 08 00CFFFFFFFFFFFFF # Stop pump (off,n/a,n/a)

# Process "Fluid Level" PGN 127505
match(CAN1, 0x01F21100, 0x01FFFF00 )
{
          I = get(DATA, UINT8)
          F = get(DATA+1, INT16)

          if (F != 0x7FFF) # Are data valid?
          {
             if (I == 0){
                    A = F * 0.004 # Tank A, %
             }
             if (I == 3){
                    D = F * 0.004 # Tank D, %
            }
          }
}
```

```
# Switch # Process "Attitude" PGN 127257
match(CAN1, 0x01F11900, 0x01FFFF00 )
{
          H = get(DATA+1, INT16)
          if (H != 0x7FFF) # Is heeling valid?
          {
             load(SLOT3) # Prepare stop pump command
             H = H * 0.0180 / M_PI # To degrees
             if (H > 0) { # Heeling to starboard
                    if (H > 20.0)
                    {
                       if (A < 100) { # Is level in A not 100%?
                         load(SLOT1)  # Run pump command
                       }
                    }
             }
             else { # Heeling to port
                    if (H < (0-20.0))
                    {
                      if (D < 100) { # Is level in D not 100%?
                        load(SLOT2)  # Other direction
                      }
                    }
             }
             send(CAN1) # Send the command to run/stop
          }
}
# End of program
```